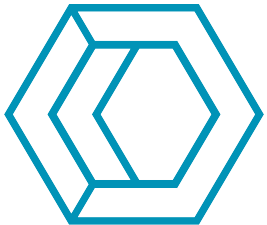


# Introduction to Machine Learning

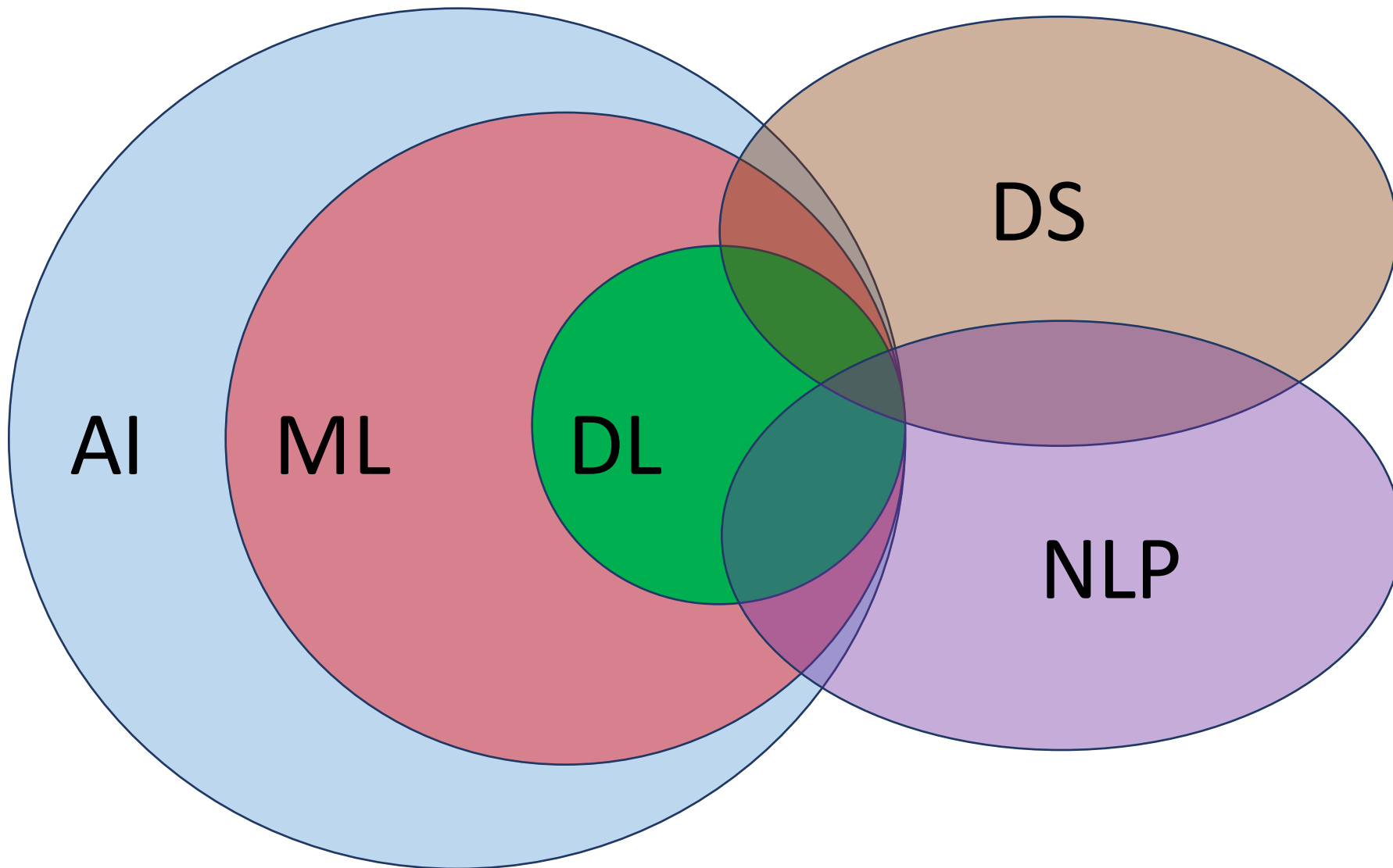
Canggih Puspo Wibowo

24-25 April 2019



KEDATA

# Popular Terms

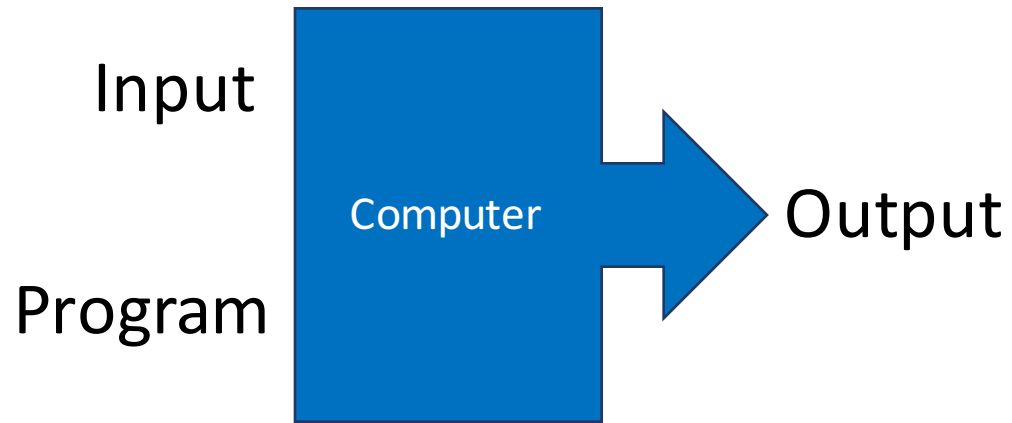


Artificial Intelligence  
Machine Learning  
Deep Learning  
Data Science  
Natural Language Processing

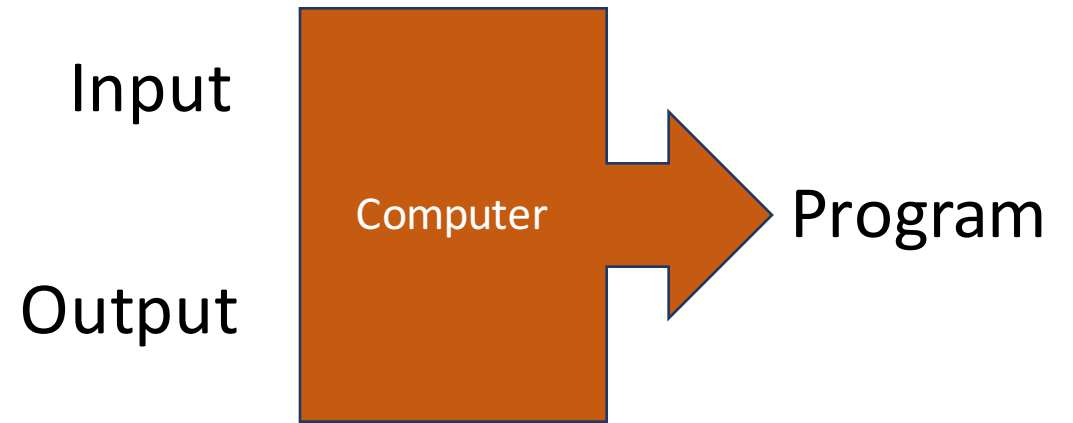
# Machine Learning Disciplines

$$\text{Machine Learning} = \begin{matrix} \text{Mathematics} \\ + \\ \text{Statistics} \\ + \\ \text{Computer Programming} \end{matrix}$$

# Machine Learning: Concept



Traditional Programming

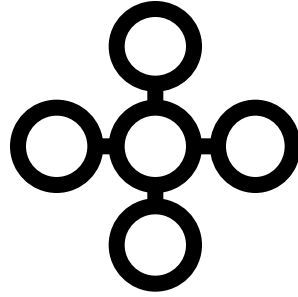


Machine Learning

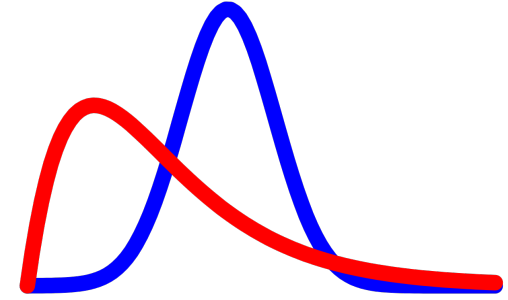
# Five Tribes of Machine Learning



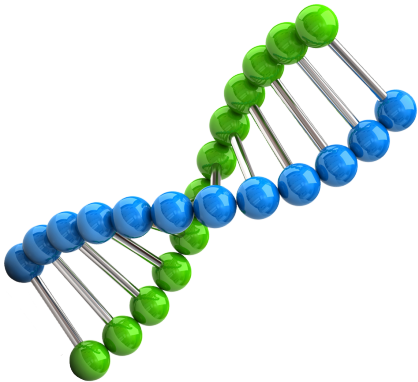
Symbolists



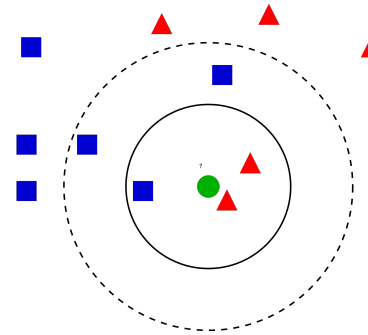
Connectionists



Bayesians



Evolutionaries

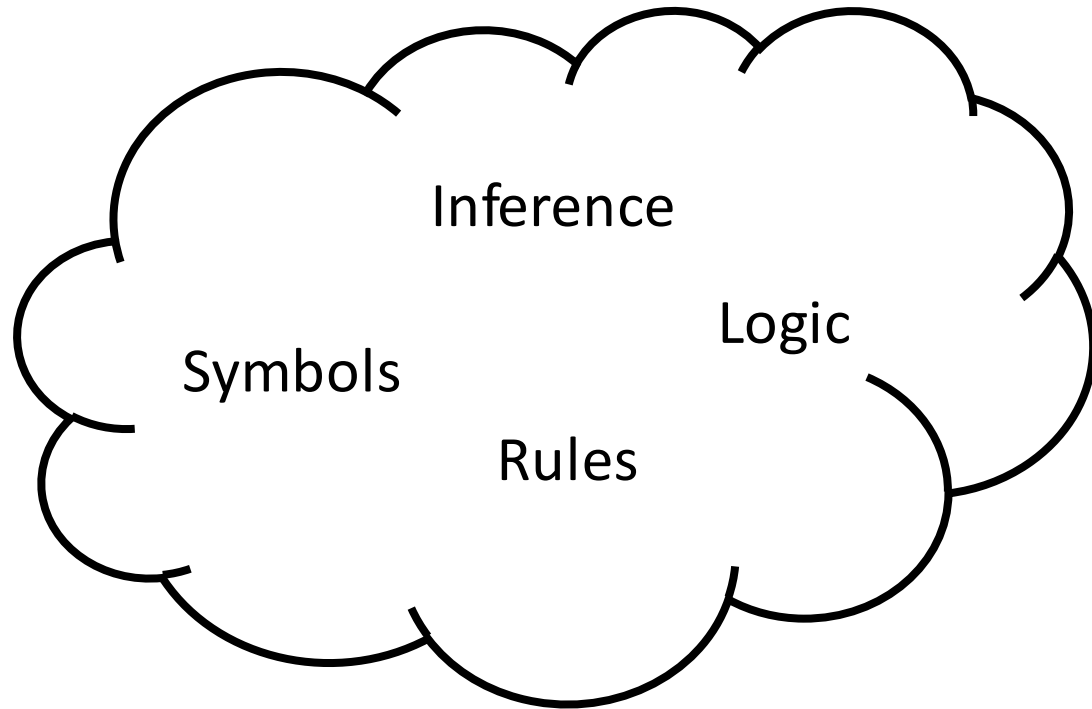


Analogizers

# ML Tribes: Symbolists

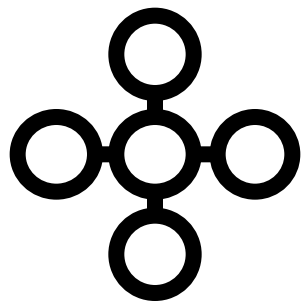


Source: **Logic**

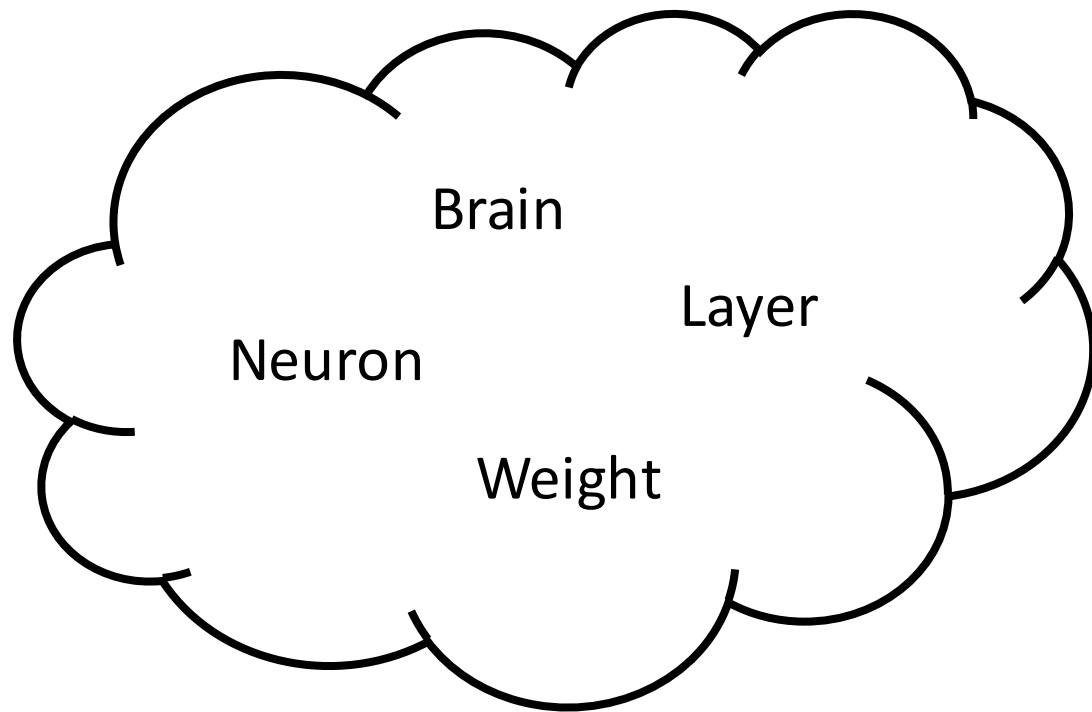


Favored Algorithm: **Decision Tree**

# ML Tribes: Connectionists

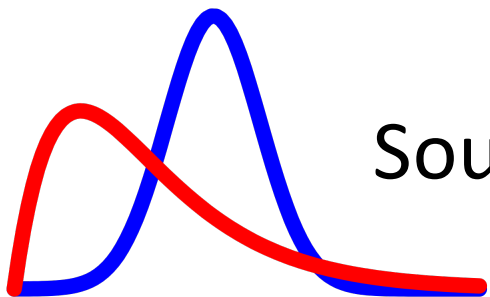


Source: Neuroscience

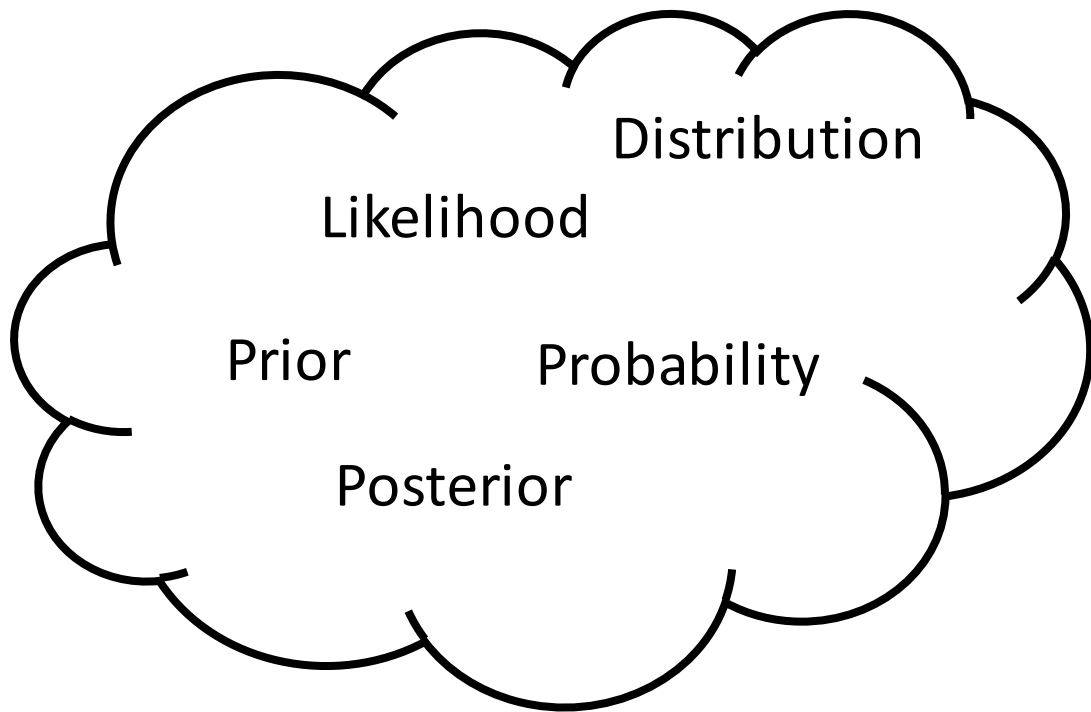


Favored Algorithm: Neural Network

# ML Tribes: Bayesians



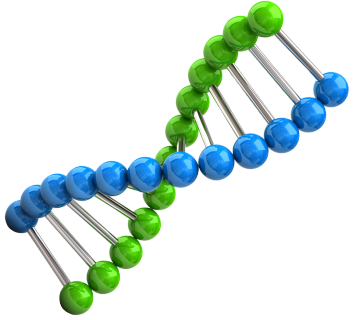
Source: **Statistics**



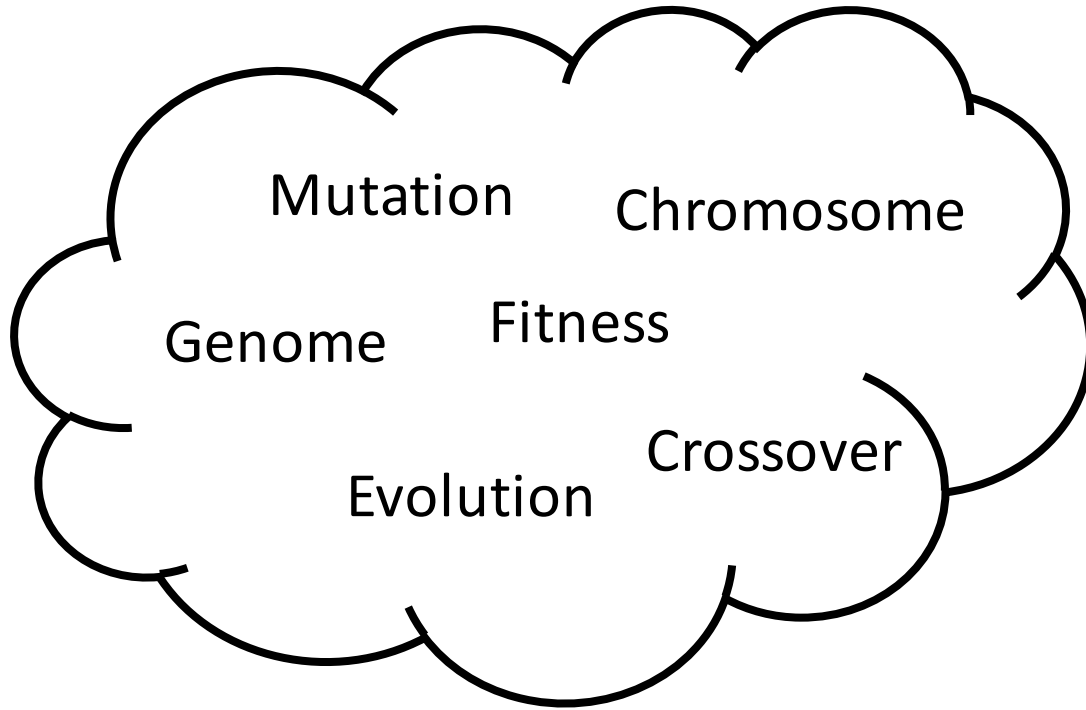
Favored Algorithm: **Markov Models**



# ML Tribes: Evolutionaries

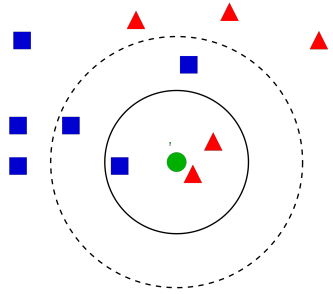


Source: **Biology**

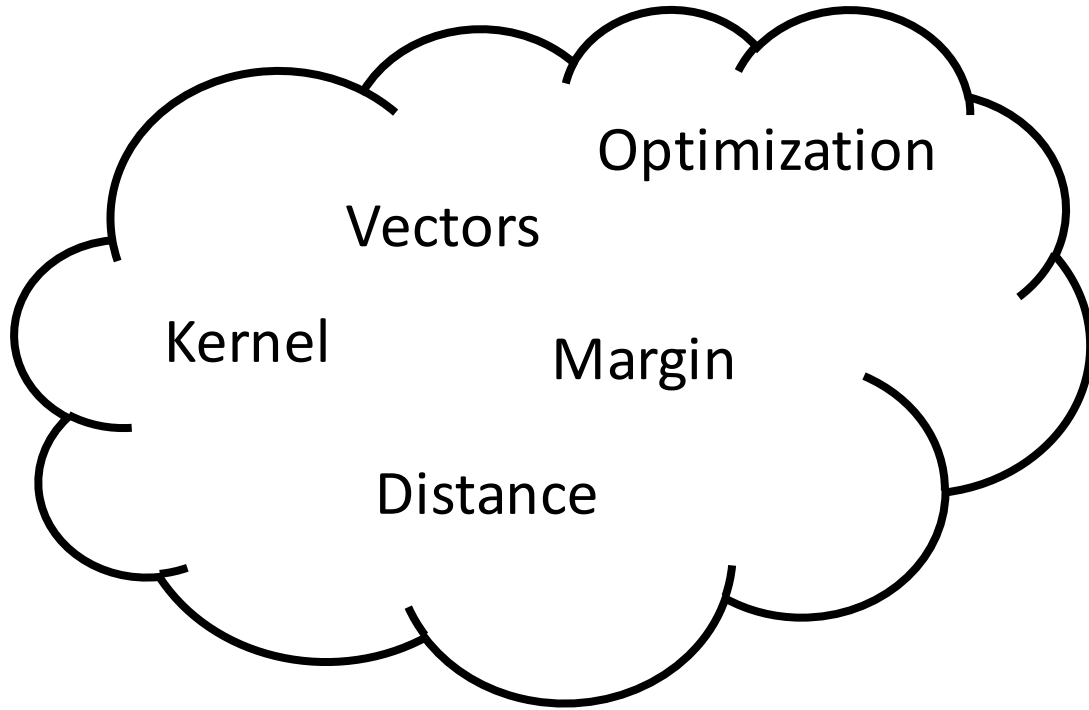


Favored Algorithm: **Genetic Algorithm**

# ML Tribes: Analogizers



Source: **Psychology**



Favored Algorithm:  
**Support Vector Machine**

# Types of Machine Learning

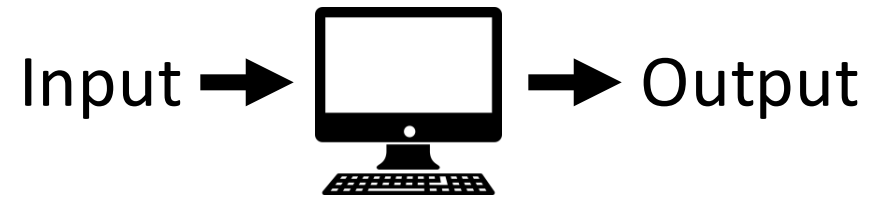
Unsupervised  
Learning

Supervised  
Learning

Reinforcement  
Learning

based on training process

# ML Types: Unsupervised Learning

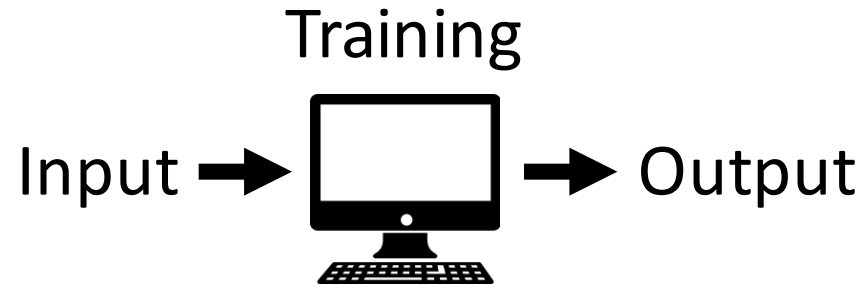


“Learning without teacher”

Machine learns  
**patterns** from the data



# ML Types: Supervised Learning



“Learning with teacher”

Machine learns  
to predict based on the data

# ML Types: Reinforcement Learning



“Learning continuously”

Machine learns  
to act based on the data



# Features in Machine Learning



# Machine Learning: Features

Color: red

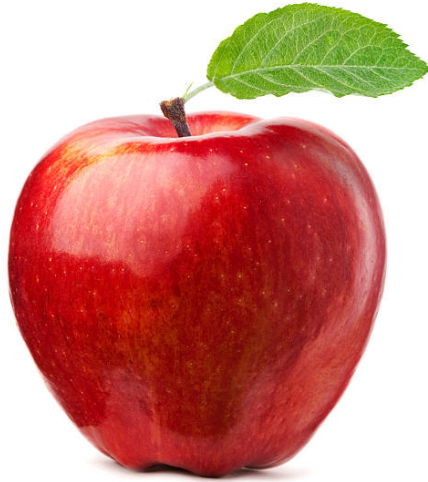
Texture: smooth

Height: 7-8 cm

Width: 6-8 cm

Weight: 200-400 gr

Taste: sweet



Color: orange

Texture: rough

Height: 6-7 cm

Width: 7-8 cm

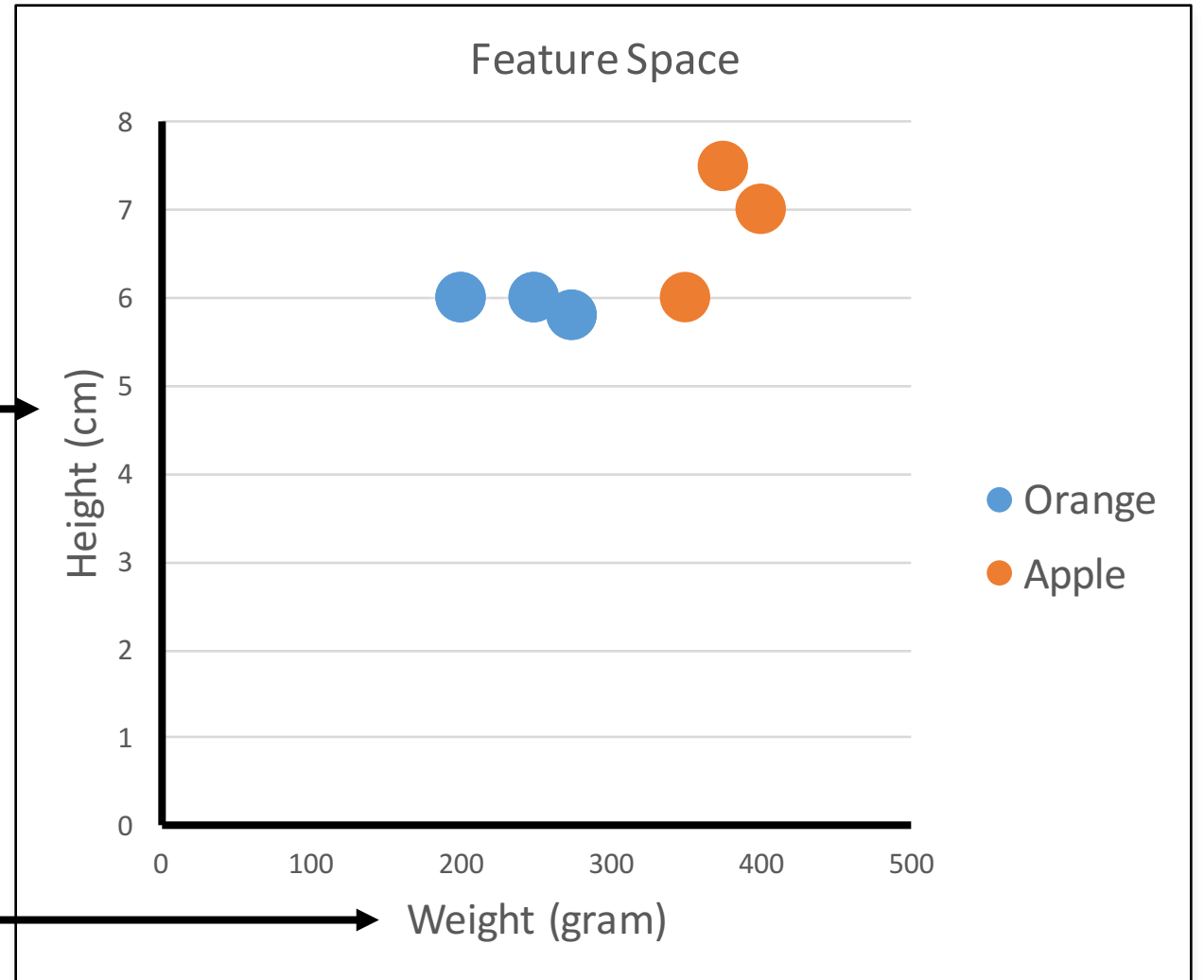
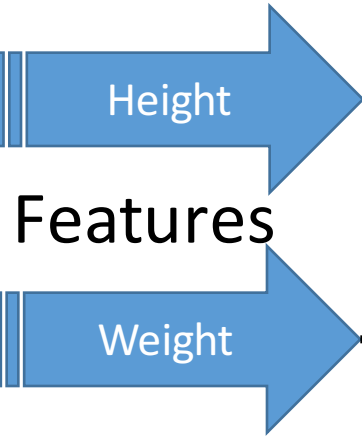
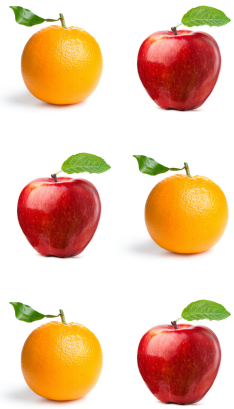
Weight: 150-350 gr

Taste: sour

Features

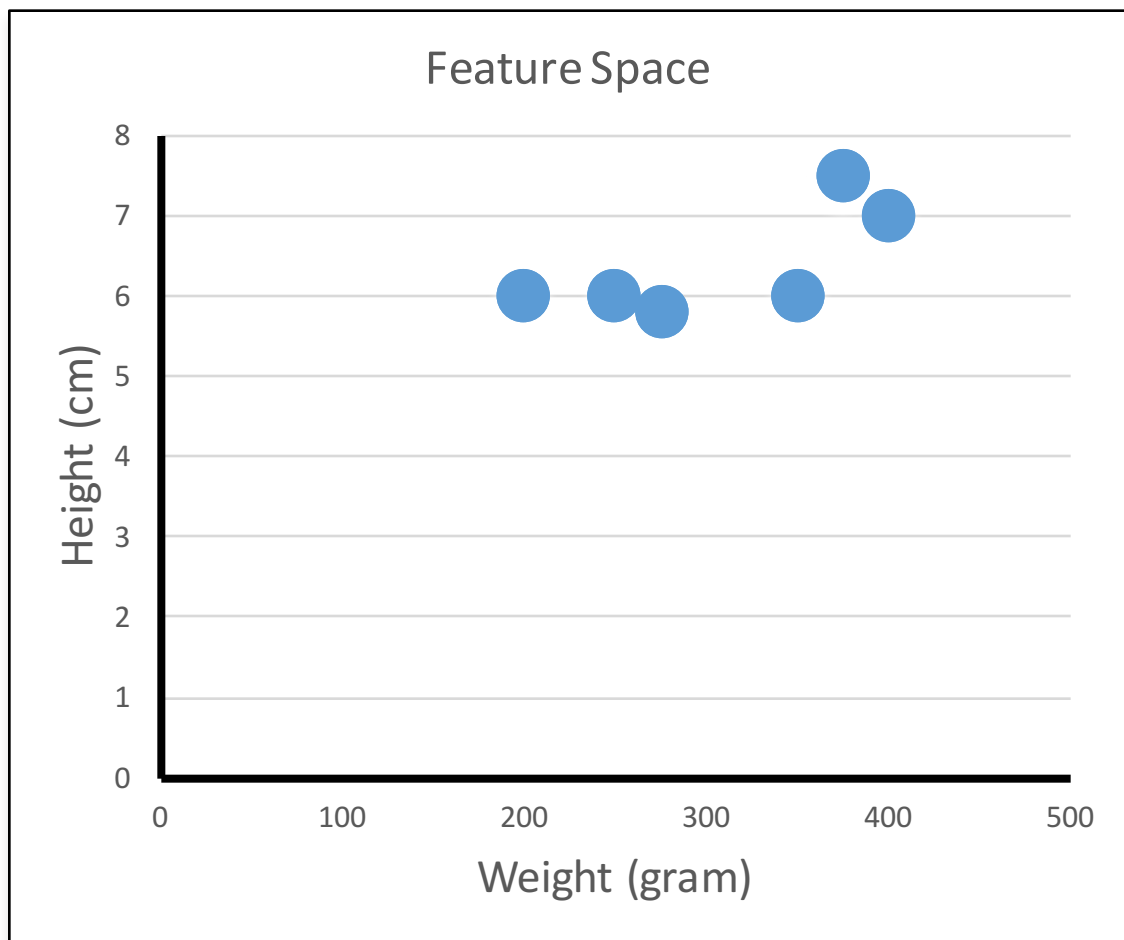


# Machine Learning: Feature Space

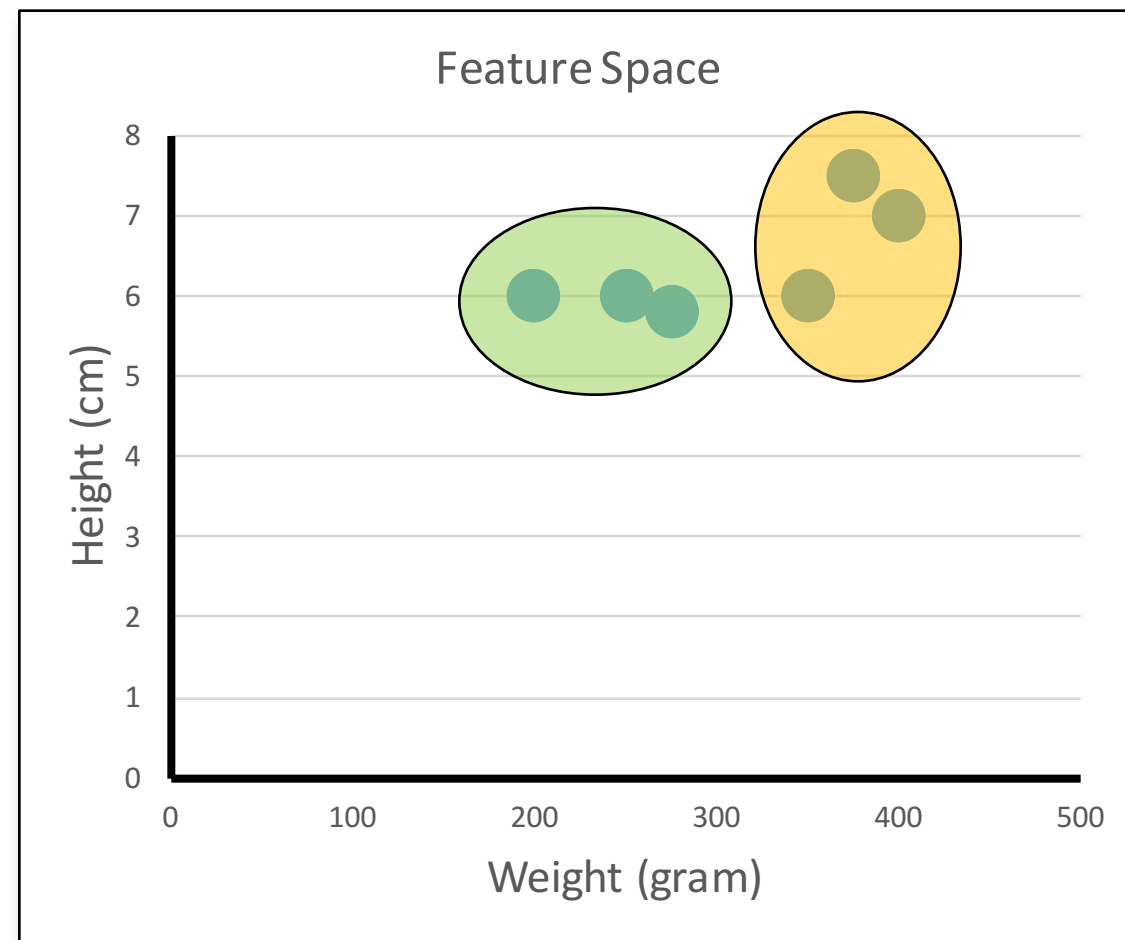


# Unsupervised Learning

Before



After

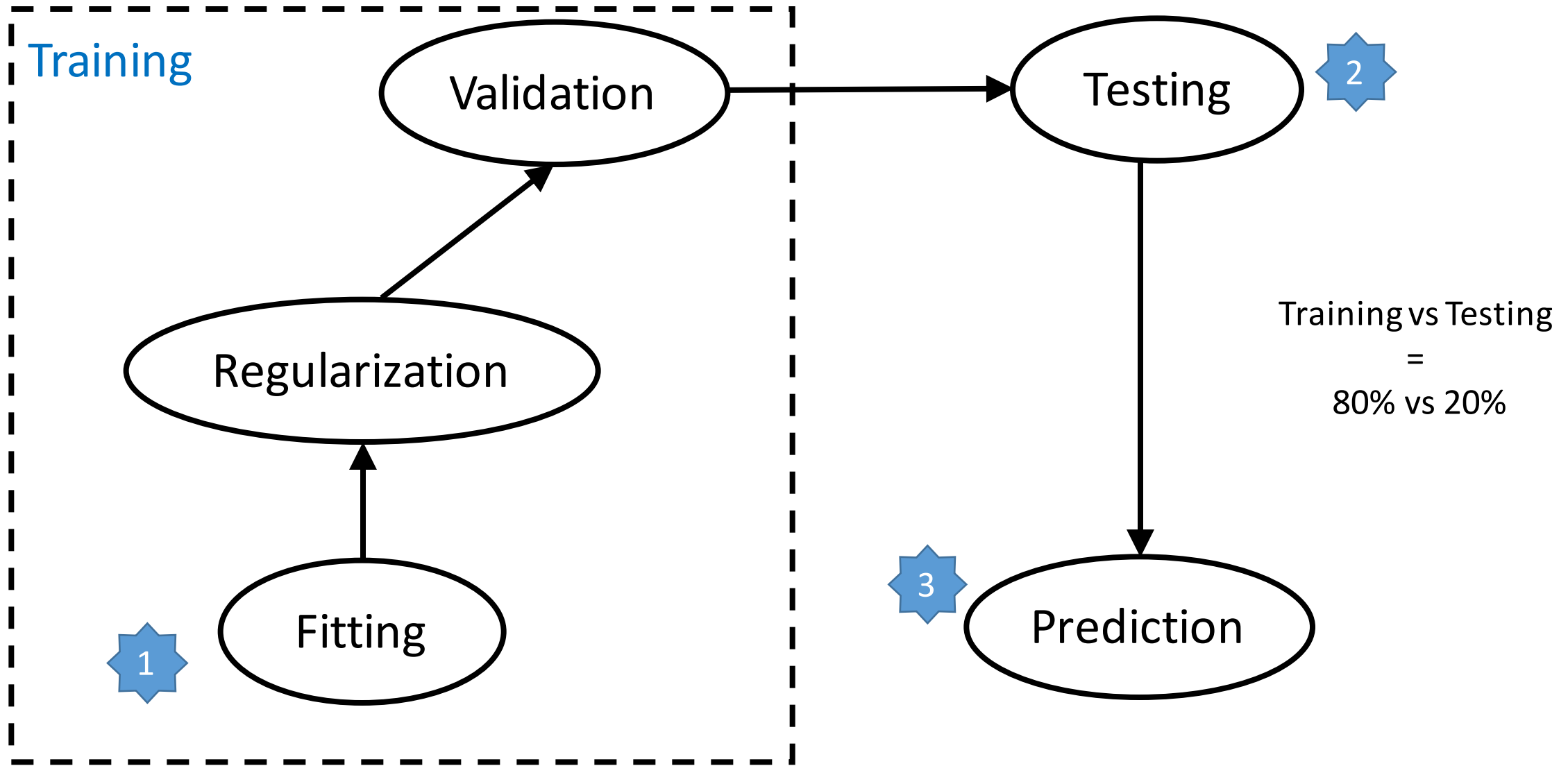




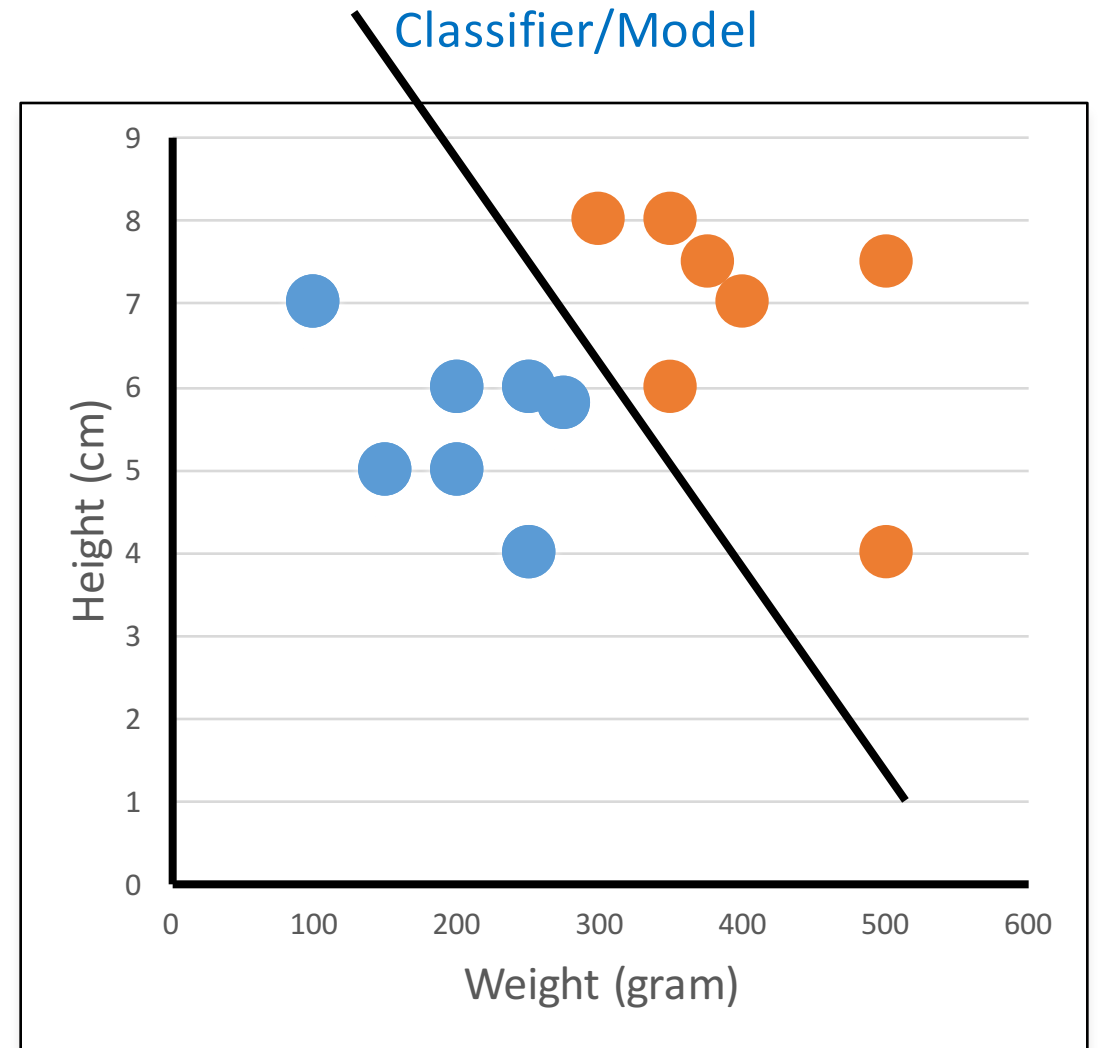
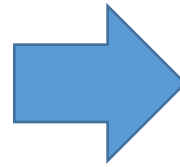
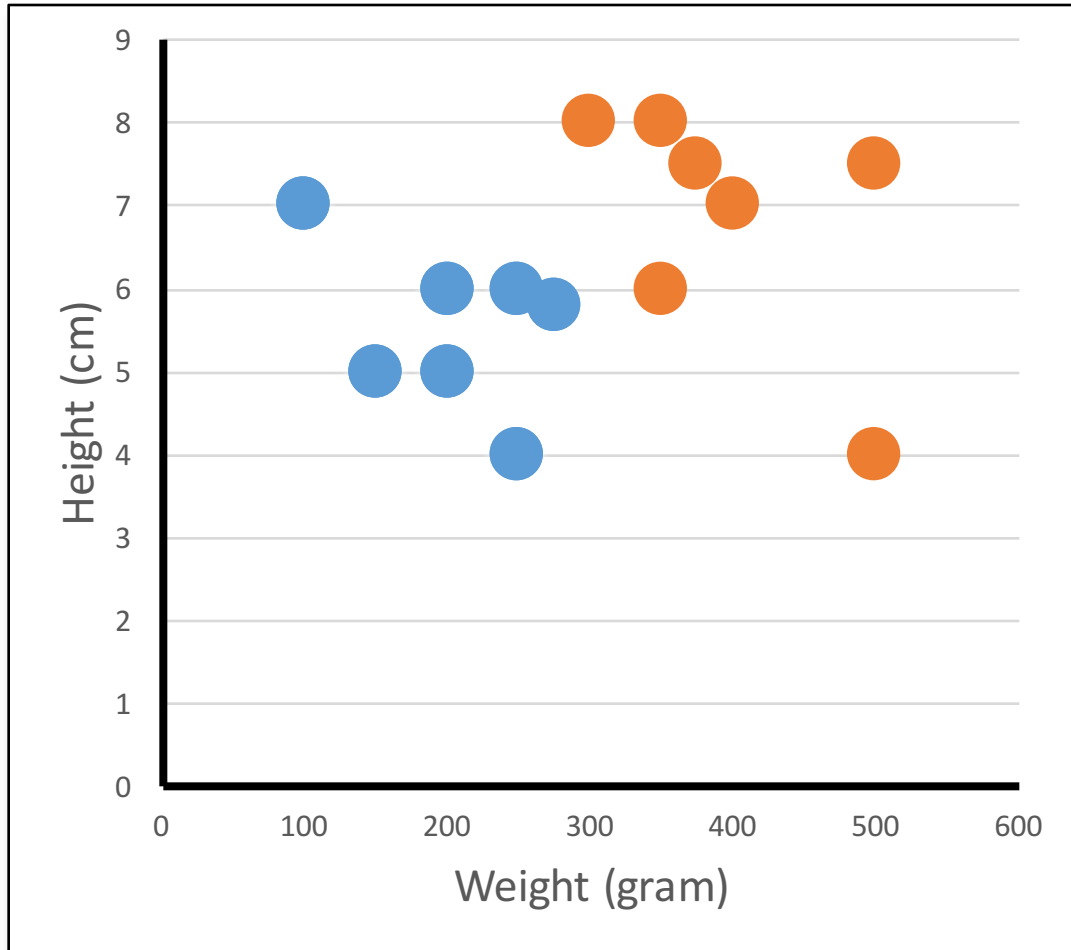
# Basic Supervised Learning



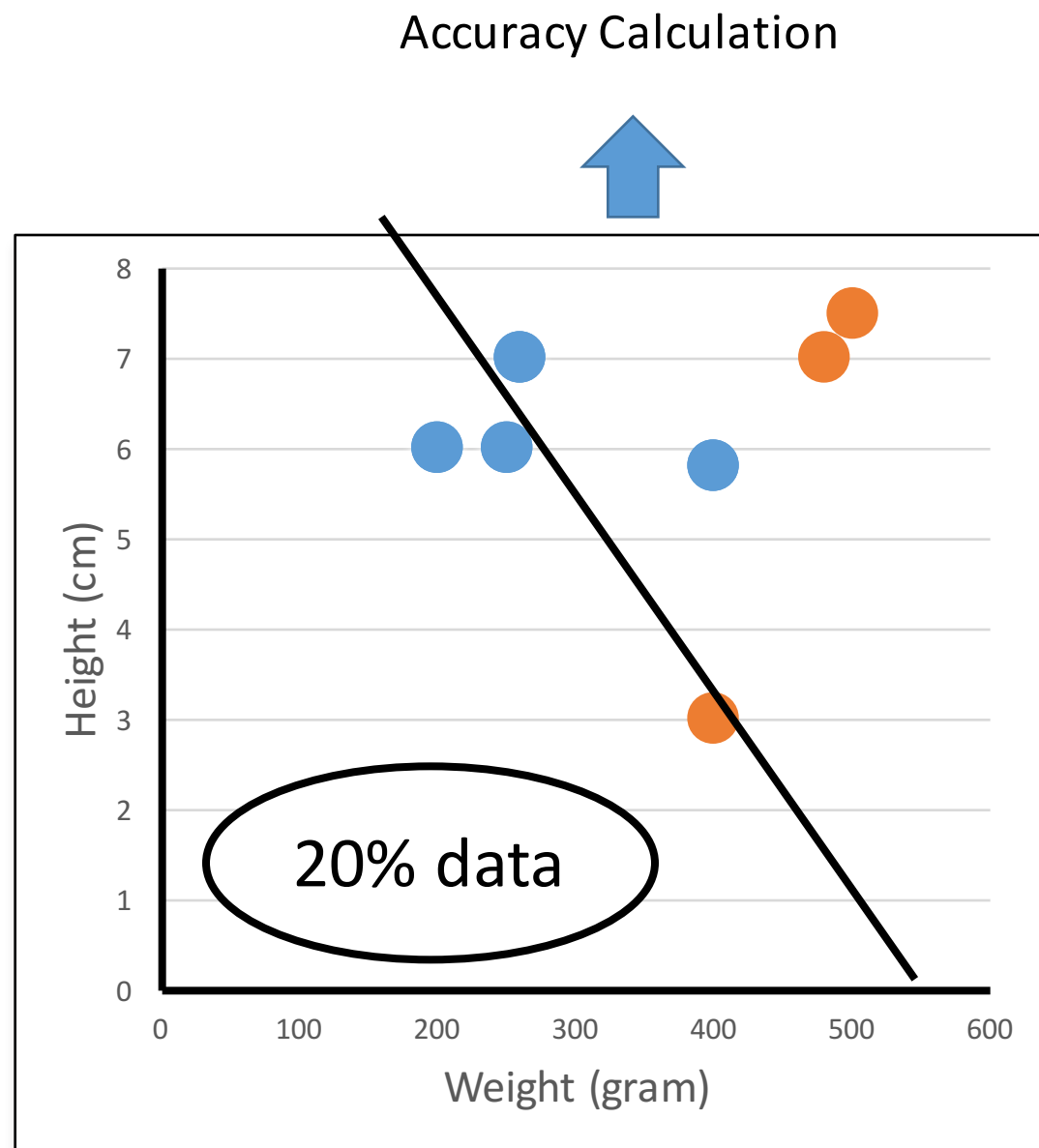
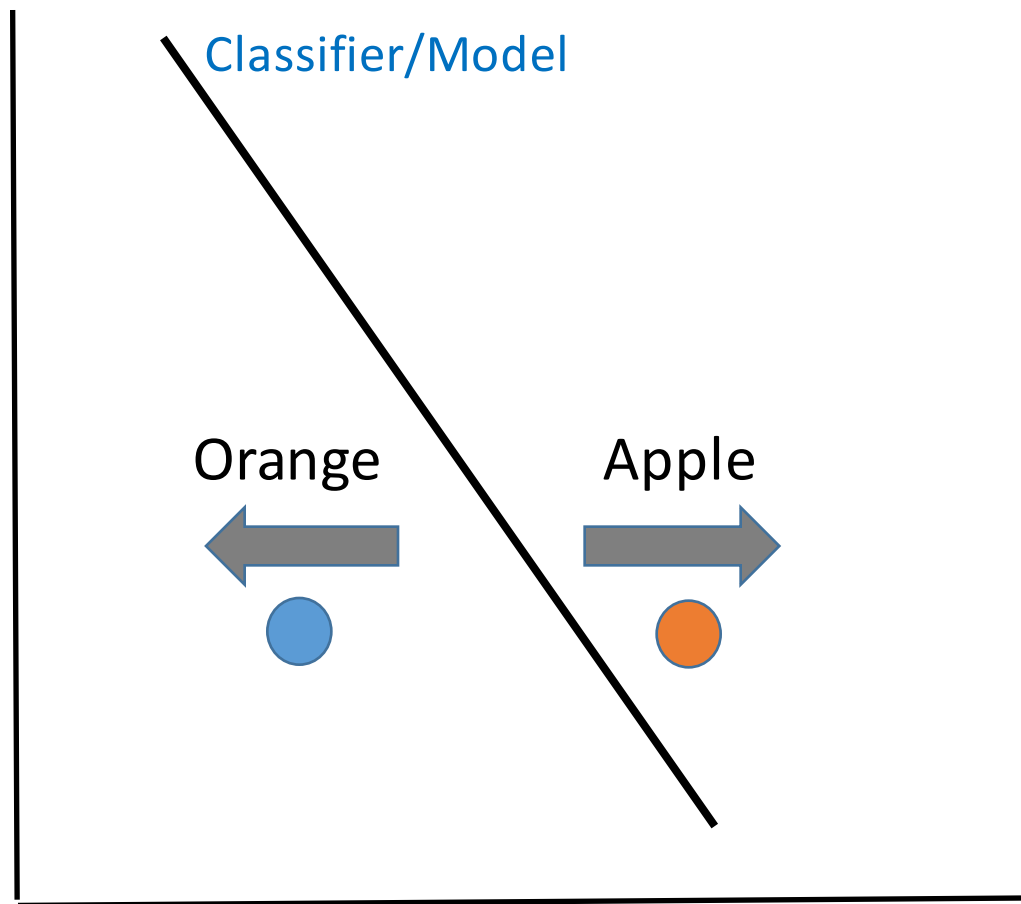
# Supervised Learning: Steps



# Supervised Learning: Model Fitting (Training)



# Supervised Learning: Testing



# Supervised Learning: Confusion Matrix

H0 : orange

H1 : others

		Actual	
		Orange	Others
Prediction	Orange	TP 2	FP 1
	Others	FN 2	TN 2

Accuracy = (TP+TN) / Total = 0.57

Precision = TP / Actual = 0.67

Recall = TP / Prediction = 0.5

F1 score = 2 (Precision x Recall) / (Precision + Recall) = 0.57

# Supervised Learning: Prediction

Predict unknown data

